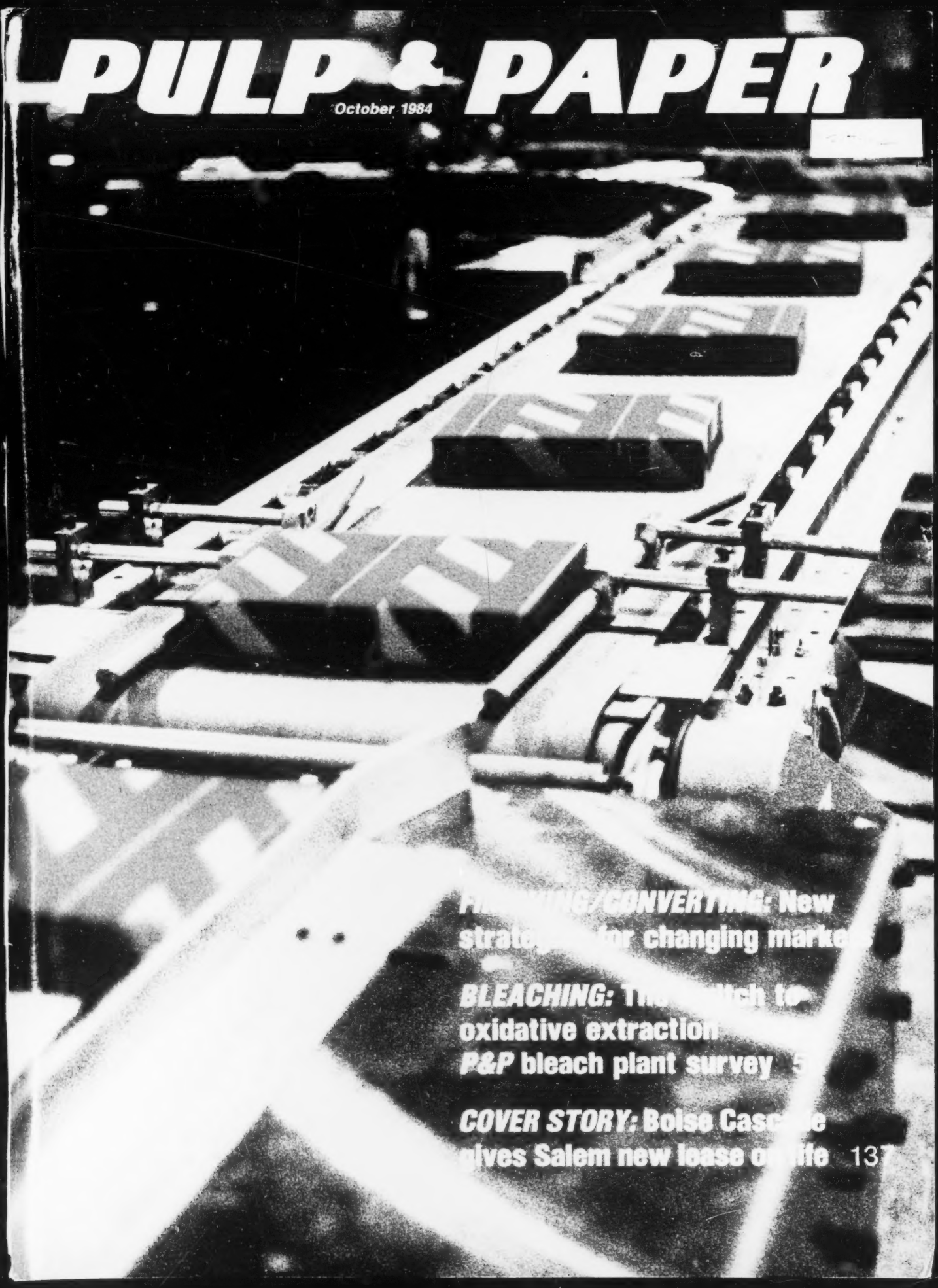
PULP & PAPER

October 1984



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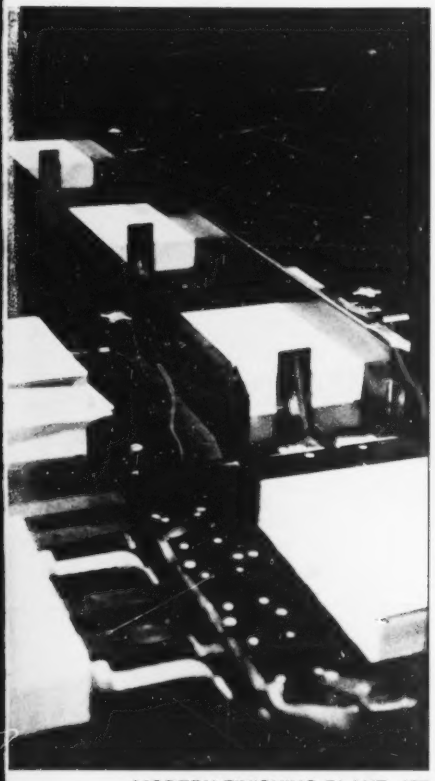

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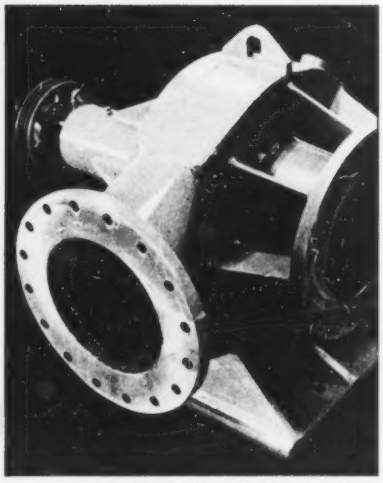

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COVER: *This issue's focus on Finishing/Converting includes a report on Boise Cascade's reconfigured "world class" finishing plant at Salem, Ore. (Photo courtesy of BE & K.)*

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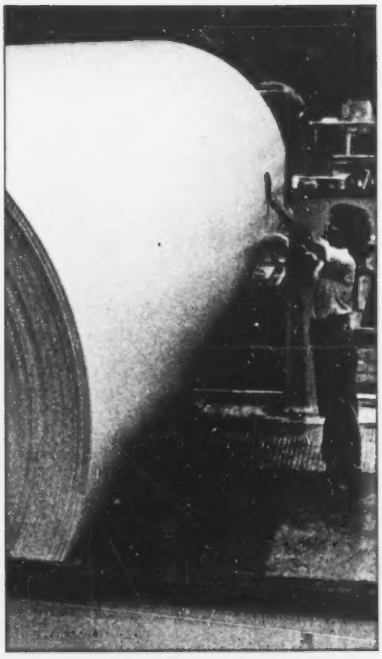

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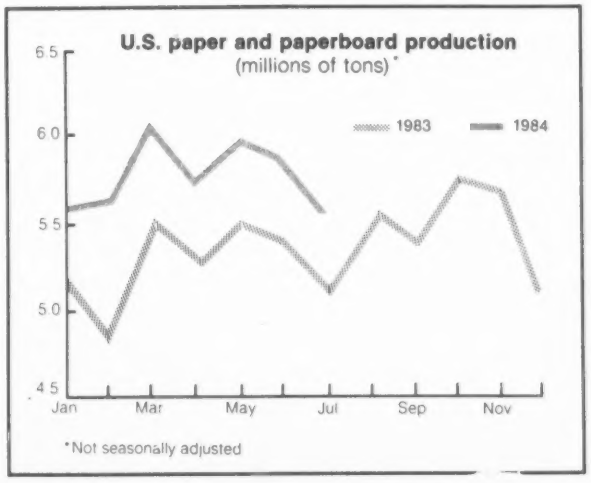
MONTH IN STATISTICS

U.S. paper and paperboard production seasonally adjusted rates moved to new highs as producers experienced less than normal downtime during the July vacation, maintenance and repair period, according to the American Paper Institute. The June-July two-month average of seasonally adjusted data showed paper and paperboard production at a rate of 69.4 million tpy. The rate for all grades was 6.5% above the average rate of all of 1983 and 7.8% ahead of the same period last year.

Among major grades, demand for printing/writing papers in most major markets was at record-high levels. Demand for the packaging grades of paper has also showed unusual strength so far this year as packaging and industrial grades rose 13% over last year's January to July period.

Canadian newsprint shipments totaled 759,000 metric tons in July, up 11.7% from July 1983, according to the Canadian Pulp & Paper Assn. Newsprint mill operating rates stood at 98% in July compared with 80% last year.



		Latest month (000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	July	451	8.2	5578	9.3
Uncoated groundwood (s)	July	127	4.1	1591	7.6
Coated paper (s)	July	478	4.8	6187	14.5
Uncoated free sheet (s)	July	707	6.5	9230	7.3
Unbleached kraft packaging and industrial (s)	July	328	15.1	3932	6.6
Tissue	July	401	8.4	4865	2.8
Total paper	**July**	**2762**	**8.3**	**34843**	**8.4**
Kraft linerboard, unbleached	July	1294	7.9	16153	9.7
Semichemical medium	July	436	13.0	5201	12.2
Bleached paperboard	July	344	12.4	4117	5.0
Recycled paperboard	July	606	8.0	8075	11.2
Total paperboard	**July**	**2780**	**8.9**	**34745**	**9.6**
Total paper and paperboard[5]	**July**	**5543**	**8.6**	**69588**	**9.0**
PULP, WASTEPAPER & FIBER[2]					
Total woodpulp production	June	4692	6.9	56186	7.8
Market pulp production	June	554	1.3	6787	4.8
Wastepaper consumption at paper/board mills	June	1294	7.4	15998	11.0
Pulpwood consumption (cords)	June	7264	1.1	88374	4.0
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft²)	July	21.257	8.5	26.736[6]	9.0
Containerboard inventories at box plants	June	2659	5.9		
INTERNATIONAL TRADE[4]					
U.S. paper imports (including products)	June	1004	20.1	10728	24.4
Imports of Canadian newsprint	June	716	10.2	7471[6]	11.2
U.S. paper exports (including products)	June	425	8.1	4564	0.2
Exports of unbleached kraft linerboard	June	176	−5.7	2093	−10.6
Exports of woodpulp	June	307	−5.5	3685	1.4
CANADIAN STATISTICS[4] (reported in metric tons)					
Total newsprint shipments	July	759	11.7	5200[6]	9.4
Operating rates	July	98%	80%	91%	83%
Inventories held by U.S. consumers	July	905	1.2		
Woodpulp shipments (export only)	July	579	7.4	3745[6]	0.6
Operating rates	July	94%	90%	83%	84%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. Canadian Pulp & Paper Assn. 5. Includes construction and wet machine grades. 6. Not annualized. 7. Not directly comparable to year ago because of coding change. (s) = shipments.

Paper-grade chemical market pulp: Recovery should continue

Statistics:	1982	1983	1984e
United States			
Production, 000 metric tons	4,213	4,694	4,970
Annual capacity, 000 tons	4,961	5,085	5,133
Utilization rate, %	84.9	92.3	96.8
Apparent U.S. consumption, 000 tons	3,972	4,672	5,140
Imports, 000 tons	1,998	2,448	2,750
Exports, 000 tons	2,239	2,470	2,580
Canada			
Production, 000 metric tons	5,284	6,071	6,200
Annual capacity, 000 tons	6,840	7,022	7,094
Utilization rate, %	77.3	86.5	87.4

e = Estimated.

GRADE STRUCTURE: Paper-grade chemical market pulp is sold in the open market and does not include captive pulp used onsite or shipped to affiliated mills within North America. Pulp is divided into grades based on whether it is made from softwood or hardwood, manufactured by the sulfate (kraft) or sulfite pulping processes, and whether it is bleached, semibleached or unbleached. Northern bleached softwood kraft (NBSK) is the premium grade because of its long fiber length and strength, although papermakers have been making more use of southern pine and hardwoods. Market pulp is sold in sheets, flash-dried bales, or rolls. Some paper pulp also goes into nonpaper uses.

PRODUCTION/CAPACITY: In 1983, North American paper-grade chemical market pulp production jumped 13.4% to 10.8 million metric tons helped by strong U.S. white paper production and some customer inventory building. Canadian production was up 14.8%; U.S. output jumped 11.4%.

U.S. production in 1984 is expected to rise another 6% to 4.97 million tons while Canadian output increases 2% to 6.2 million tons. The larger increase in the U.S. and the smaller rise in Canada reflect the impact of the six-week British Columbia labor dispute earlier this year, which resulted in the loss of more than 600,000 tons of potential production.

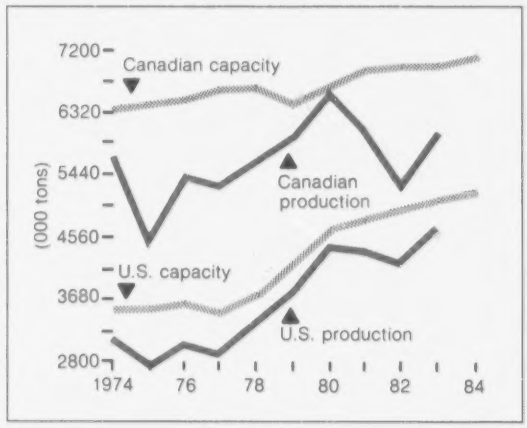
Producer inventories at North American and Scandinavian (Norscan) market pulp mills remained fairly stable at between 1.5 to 1.6 million tons through most of last year but dropped to almost 900,000 tons in February as customers built up stocks during the labor dispute. Producer stocks have since climbed to 1.2 million tons as of the end of July.

PRICING: Pulp prices rose dramatically this year thanks to strong white paper output and the British Columbia labor dispute. After firming only slightly last year, the price of NBSK in the U.S. jumped about $100/ton in two consecutive quarterly increases to $540/metric ton on Apr. 1. But the return of British Columbian mills to full production, rising inventory levels, and the strong U.S. dollar have caused some discounting from the list levels. Skepticism existed over whether producers would be able to push through another price hike this year without a strong comeback in U.S. and European white paper output and weakening in the dollar.

Another factor that may make a price hike difficult this year is a bulge of new capacity coming online, including Leaf River Forest Products' 335,000-tpy bleached kraft pulp mill in New Augusta, Miss., and a 320,000-tpy pulp line at International Paper's reconfigured Georgetown, S.C., mill. Several new mills were also scheduled to start up in Europe.

Beyond the current bulge, Norscan capacity is expected to rise only 4% between 1983-86. Pulp prices will probably show a gradual rise through 1985 and perhaps into 1986 with NBSK peaking at $650 to $700/ton by some forecasts.

Year-end U.S. market pulp prices in $/metric ton NBSK: 1976, $410; 1977, $342; 1978, $375; 1979, $460; 1980, $530; 1981, $530/$565; 1982, $440; 1983, $450; 1984 mid-year, $540—some discounting. (See *P&P PriceBook* for details.)



Estimated capacities of major companies are*:

	Annual capacity (000 metric tons)	Capacity share (%)
1. Weyerhaeuser[1,2,3,5,6]	900	7.3
2. Georgia-Pacific[1,2,5]	700	5.7
3. International Paper[1,2,6**]	620†	5.1
4. Parsons & Whittemore[1,2]	580	4.7
5. Great Lakes Forest Products[1,2,3]	575	4.7
6. Westar Timber[1,3]	570	4.7
7. Canadian Forest Producst[1,3,4]	565	4.6
8. B.C. Forest Products[1,3,4]	480	3.9
9. MacMillan Bloedel[1,3,4]	460	3.8
10. Leaf River Forest Products[1,2,3]	410	3.4
11. Northwood Pulp & Timber[1]	370	3.0
12. ITT Rayonier[1,5,6**]	345	2.8

North American capacity (1984): 12.227 million tons
Capacity share of top five companies: 27.6%
Capacity share of top ten companies: 47.9%

*Several companies with major holdings in the market pulp sector are not shown above to avoid double counting of capacity: Noranda, 610,000 tpy (49% of MB, 50% of Northwood, 100% of Maclaren, 63% of Fraser); Canadian Pacific, 600,000 (54% of Great Lakes, 100% of CIP); and Mead 480,000 tpy (50% of Northwood, 50% of Brunswick, and 28% of BCFP).
**Exact capacity difficult to estimate because some of company's mills also make dissolving pulp.
†Includes new Georgetown, S.C., pulp line (net of production shifted at Texarkana, Texas).

1. Bleached softwood kraft; 2. Hardwood kraft; 3. Semibleached softwood kraft; 4. Unbleached kraft; 5. Bleached hardwood kraft; 6. Fluff pulp.

(News section continues on page 23)

WORLD CAPACITY

FAO capacity survey shows growth

Worldwide paper-grade pulp capacity in 1983 was 153.2 million metric tpy with woodpulp accounting for 144.0 million tons or 94% and other fiber pulps adding 9.2 million ton. Pulp capacity is expected to rise to 165.4 million tons in 1988, an annual growth rate of 1.5%, reports the United Nation's Food & Agriculture Organization in its "FAO Pulp & Paper Capacities 1983-1988."

Paper and paperboard capacity rose 0.7%, compared with a 1.4% increase in 1982. Capacity in 1983 was 206 million tpy and is expected to increase to 224 million tons by 1988, an average growth of 1.7% per year.

Pulp. Chemical grades represent 64% of total pulp for papermaking, a percentage they have held for some years and at which they are expected to remain.

The main growth continues to be in thermomechanical pulp. World capacity in 1983 was 9.38 million tpy, and estimated expansion to 1988 is 3.1 million tons, a 33% rise. The "developed market economies" have 96% of 1983 capacity, and 54% of this is in North America. Furthermore, Canada and the U.S. account for more than half the estimated growth in world TMP capacity: by 1988, 54% of the world's capacity is expected to be located in these two countries. India introduced TMP capacity in 1983.

Mechanical pulp capacity continues to fall off with a reduction of 0.75 million tons during 1983. The largest reductions were in Canada, West Germany and Sweden.

Market pulp production capacity in 1983 was estimated at 29.3 million tpy in 1983, with an indicated increase of 5% to 31 million tons by 1986. A small decrease is estimated for Finland which should be offset by increases for Sweden and Norway. Regional distribution in 1983 was 12.5 million tons in North America, 6.4 million tons in Nordic countries, 3.0 million tons in the rest of Europe, 2.0 million tons in the U.S.S.R., 2.2 million tons in Latin America, 0.7 million tons in Oceania, and 0.5 million tons in Africa.

Paper grades. World capacity for paper and paperboard in 1983, reports FAO, was 205.9 million tons. This is estimated to increase by 18 million tons to a total of 224 million tons in 1988, an annual growth rate of 1.7%.

World newsprint capacity in 1983 of 30.7 million tons constitutes 15% of world paper and paperboard capacity. Estimated growth of 2.7 million tons for newsprint in the 1983-88 period will be at 1.7% per year (about half the 3.1% per year rate of 1978-83).

Printing/writing paper capacity in 1983 was 51.3 million tons and is estimated to reach 57.4 million tons by 1988 which is an annual rate of 2.4%.

Capacity for other paper and board grades in 1983 was 123.8 million tons. Capacity in 1988 is estimated to be 133.1 million tons, an expected growth rate of 1.5% over the five years.

A continuing reduction in the ratio between pulp and paper capacity is reported in the FAO survey. In 1969, pulp capacity was 81.5% of papermaking capacity. In 1979 the ratio had declined to 77.1%, and in 1983 it had dropped to 74.4%. A further decline in the apparent ratio of paper pulp to paper to 73.8% during 1988 is forecasted .

World pulp, paper and paperboard capacity, 1973-88
(million metric tons)

	1973	1978	1983	1988
Total woodpulp, paper grades	119.8	134.9	144.0	154.8
Mechanical[1]	28.9	32.6	35.5	38.5
Semichemical[2]	9.9	10.5	9.6	10.1
Chemical	81.1	91.9	98.6	105.8
Other fiber pulp	8.2	10.4	9.2	10.6
Dissolving pulp	5.9	6.1	6.1	6.3
Total paper and paperboard	160.7	187.6	205.9	224.1
Newsprint	24.7	26.4	30.8	33.5
Printing and writing	35.7	42.8	51.3	57.4
Other paper and paperboard	100.3	118.4	123.8	133.1

1. Including thermomechanical pulp.
2. Including chemigroundwood.

Capacity increases to 1988: world paper woodpulp

	Capacity (000 metric tons)		Average annual increase (%)	
	1983	1988	1978-83	1983-88
World total	144,007	154,773	1.3%	1.5%
Market economies	118,426	126,545	0.9	1.3
Northern America	72,749	76,415	1.7	1.0
Japan	12,006	12,158	−0.1	0.3
Western Europe	30,518	33,689	−0.6	2.0
Oceania	2,326	2,670	2.2	2.8
Others	827	1,613	3.9	14.3
Market economies	8,415	10,450	7.3	4.4
Africa	724	815	15.4	2.4
Latin America	5,800	7,113	5.6	4.2
Asia	1,891	2,522	10.7	5.9
Centrally planned economies	17,166	17,778	1.7	0.7
Asia	1,167	1,282	−13.8	1.9
Eastern Europe	4,354	4,446	3.5	0.4
U.S.S.R.	11,645	12,050	3.8	0.7

Capacity increases to 1988: world paper and paperboard

	Capacity (000 metric tons)		Average annual increase (%)	
	1983	1988	1978-83	1983-88
World total	205,933	224,079	1.9%	1.7%
Market economies	161,377	174,338	1.7	1.6
Northern America	81,219	85,200	1.9	1.0
Japan	23,198	24,908	1.9	1.4
Western Europe	52,770	59,148	1.1	2.3
Oceania	2,509	2,807	1.8	2.3
Others	1,681	2,275	6.6	6.2
Market economies	18,783	22,583	6.6	3.8
Africa	924	1,115	5.4	3.8
Latin America	10,240	12,659	5.3	4.3
Asia	7,619	8,809	8.8	2.9
Centrally planned economies	25,773	27,158	0.1	1.1
Asia	5,837	6,284	−7.7	1.5
Eastern Europe	6,436	6,874	1.8	1.3
U.S.S.R.	13,500	14,000	4.2	0.7

Wide acceptance of new bleaching

P&P's latest exclusive survey of U.S. bleach plant operations finds higher use of cheaper chemicals and better equipment to reduce costs

By MICHAEL J. DUCEY, Technical Editor

■ Last year, *Pulp & Paper* presented a comprehensive summary of the latest technology in bleach plant operations (see Nov. 1983, p. 53). That report also included summarized data for the average chemical usage of producers by grade, sequence, species, capacity, number of towers and geographical location. This year a follow-up survey was conducted to determine the general acceptance of the newly available equipment and the benefits of this equipment.

Table 1 represents a breakdown of the fully bleached chemical pulp producers surveyed. According to the latest American Paper Institute capacity reports, 22.4 million tons of bleached pulp are produced annually (the United Nations' Food & Agriculture Organization's estimates are closer to 21 million) in the U.S. *P&P* surveyed producers of more than 16 million tons, or close to 70% of the total. Three-quarters of those producers provided detailed operating data, and all producers supplied details of their sequence modification plans. Therefore, *P&P* editors feel that this survey is quite accurate in evaluating the state of bleach plant operations in the U.S.

We plan to conduct a follow-up survey next year, as the applications of new bleaching technology are expected to grow. We will again conduct a detailed survey of average bleach plant chemical usage in the hopes of evaluating the overall reduction of chemicals in the bleaching process nationwide—by the categories shown in Table 1.

CHLORINE DIOXIDE SUBSTITUTION. A recent publication reviewing 134 reports dating back to 1950 on chlorine dioxide substitution in the first chlorination stage of bleach plants revealed that moving from low substitution (4% to 15%) to high substitution (50% to 70%) does not produce significant benefits (Table 2).[1] All reports cited the many operating variables involved in the chlorination stage (temperature, retention time, chemical charge, pH, etc.) as affecting pulp and effluent properties differently. Differing sequences, mixing techniques and modes of addition (premixed or sequential) were also mentioned as contributing to the conflicting conclusions.

P&P's survey found that mills using low substitution, given the capital investment to do so, are satisfied with the results and do not plan to move into a ClO_2-dominated first stage.

Limitations of ClO_2 generating plants, the rising cost of sodium chlorate, and cheaper chemical substitution methods have been given as the major reasons for this decision. Pulp grade and bleach plant sequence (where ClO_2 is already used) are not factors in the decision to

TABLE 1: **Breakdown of fully bleached chemical pulp mills, grouped geographically and by process specifications.**

Total mills responding	69
Total bleaching lines	99
Total tonnage (tpy)	16,115,750
Total fully bleached chemical pulp capacity (tpy)	22,411,000
Capacity represented by survey	72%
Geographic distribution	
Region	**Number of lines**
South	51
Northeast	14
West	22
Midewest	12
Process distribution	
Species[1]	**Number of lines**
Hardwood	54
Softwood	64
Blends	6
Number of stages (towers)	
3	13
4	29
5	43
6	12
Displacement	3
End product[2]	
Market pulp	40
Fine paper	59
Tissue	12
Board	20
Fully bleached capacity (tpd)	
Capacity	**Number of lines**
700 and over	16
400–700	59
Below 400	34

1. Lines running both hardwood and softwood were counted twice.
2. Some lines produce more than one grade.

equipment and technology revealed

substitute ClO_2 for Cl_2 in the C stage. Reduced chemical consumption, viscosity increases, and effluent reduction are seen as the major reasons for adding ClO_2 in the chlorination stage.

OXYGEN-ENRICHED EXTRACTION. Predictions in last year's survey as to the growth of oxygen-enriched extraction were correct. The question that remained to be answered was: if a mill installs a high-cost, medium-consistency mixer and an oxygen supply system and provides proper time for retention, will it recover the capital investment through chemical savings within a reasonable amount of time? Fourteen mills are answering yes by installing 19 lines of oxygen-enriched extraction so far this year.

The economics are quite simple. Capital investment is typically between $100,000 and $500,000 (depending on the existing system) to bring the process online. Oxygen, at a cost of $0.05/lb, will replace chlorine dioxide (typically costing $0.50/lb to produce) in a 1.5:1 ratio. Results vary with each system, but the survey found most producers inject about 10 lb of oxygen/ton of pulp in the E_O stage, cutting ClO_2 usage in the latter stages by 6 lb/ton. Adding up the chemical cost difference for each ton produced and multiplying by the annual output of bleached pulp, the ROI should be greater than 85% when the capital investment is divided into the chemical savings. All mills using E_O during the last year agree with this conclusion, and mills that have not completed a full year of operation are confident that they will attain this project goal.

TABLE 2: **Summary of ClO_2 substitution benefits by amount substituted and pulp type.**

	Softwood kraft	Hardwood kraft	Sulfite
Pulp properties			
Yield	Cd = Dc	?	?
Shives	Cd = Dc	?	?
Physical strength	Cd = Dc	Cd = Dc	?
Viscosity	Cd = Dc	Cd = Dc	Cd = Dc
Chemical consumption	Dc > Cd	Dc > Cd	Dc > Cd
Brightness reversion	Cd = Dc	Dc > Cd	Dc > Cd
Effluent properties			
BOD	?	?	?
COD	Dc > Cd	Cd = Dc	?
TOC	Cd = Dc	Cd = Dc	Cd = Dc
Color	Dc > Cd	Dc > Cd	?
Chlorinated phenolics	Cd = Dc	Cd = Dc	?
Mutagenicity	Dc > Cd	?	Dc > Cd
Toxicity	Cd = Dc	Cd = Dc	?
Number of users[1]	Cd = 18 Dc = 4	Cd = 20 Dc = 4	Cd = 1 Dc = 0

Cd indicates below a 20% substitution of ClO_2 (as Cl_2).
Dc indicates above a 20% subsitution of ClO_2 (as Cl_2).
Cd = Dc means that low substitution is equivalent to high substitution.
Dc > Cd means high substitution is superior to low substitution.
? = Studies are inconclusive.
1. Lines with pulp blends are counted twice.

Last year the three major types of E_O processes known to be running were described. Two of those types remain in operation, and a few others have recently been employed. The major difference between processes is mixing technique. The cost varies proportionately to the type of equipment used. All existing sequences seem to be adaptable to oxygen addition, and more engineering design may be on the way.

The most popular method of oxygen-enriched extraction uses a dynamic, medium-consistency mixer. The mixer will accept pulp from a thick stock pump at 12% to 14% consistency. Pulp is rapidly mixed with injected oxygen in less than a second in the central portion of the unit. The mixer fluidizes the stock and oxygen in the mixing zone, allowing oxygen to adhere to the fiber and react quickly and thoroughly. The mixers have not experienced problems of plugging, and fiber damage has not been reported. The process continues as the mixer sends the pulp to a retention area.

Justification of the installation of a preretention tube has been a challenge due to its cost, space requirements and safety hazards. Typically a mill with an existing downflow extraction tower will build a tube for retaining pulp for 5 to 10 min. The tube generally is more than 45 ft high and is 4 ft in dia. Tube height is a major factor in maintaining back pressure in the vessel. Some suppliers and mills commented that the reaction time required is really 1 to 2 min, and if piping between mixer and tower retains the mixture that long, a tube may not be necessary. Upflow extraction towers do not need preretention tubes if sufficient pressure is maintained.

Two suppliers have introduced static mixers in this market. Static mixers cost about one-tenth the amount of mechanical mixers and, of course, do not have power requirements. They are easy to install, require less floor space, and are easy to maintain since there are no moving parts. Static mixers also use a medium consistency and give similar (but lower) benefits in chemical savings due to lowered consumption of more expensive chemi-

cals. Currently two U.S. mills, a Canadian and a Japanese mill are running E_O processes with static mixers.

Two new types of E_O systems are in trial operations in the U.S. One involves injection of pulp into a medium-consistency pump, which then send the mixture to a packed preretention tube. Another involves a special injector developed by Linde that disperses oxygen through the pulp without any mixing equipment. These methods are awaiting final evaluation before they are introduced into the market, but preliminary results indicate cost effectiveness comparable to the other techniques.

Contrary to last year's observations on the benefits of oxidative extraction, effluent reduction has not been reported as a benefit. Difficulty in measuring the components of effluent from E_O stages and the fact that no downward trend in effluent has been observed after installation of E_O make any claims of effluent reduction questionable. Effluent reduction had been a chief reason for an E_O study in many mills, and two U.S. producers rejected proposals based on that benefit.

PEROXIDE ADDITION. As reported last year, the addition of hydrogen peroxide in the bleaching sequence has a number of benefits. For a low capital investment (typically around $10,000) and easy installation, a mill can add peroxide to increase brightness, eliminate brightness reversion and reduce chemical consumption and effluent. Most mills reporting H_2O_2 addition trials last year have installed full online systems.

Peroxide can be introduced to pulp at the E_1 or E_2 stages, or enroute to the high-density storage tower. The survey found that most mills using H_2O_2 apply it at the latter part of the bleaching line for its brightness benefits. Chemical additions of around 5 lb/ton (on both species) seems to be a common usage. The survey did not find widespread peroxide use in the E_1 stage to reduce effluent. Peroxide additions continue to be cost effective as price stability of the chemical is maintained and consumption of higher-cost chemicals (such as ClO_2) is reduced. To install a system, a mill needs a storage tank, metering equipment and piping.

DISPLACEMENT BLEACHING. Almost a decade ago, the first displacement bleach plant was constructed by Kamyr Inc. for Temple-Eastex Inc. at Evadale, Texas. Technological advances in dynamic bleaching and the continuous diffuser led to further advances in the process, which is still being improved today. The latest U.S. installation, brought online at the end of 1983, was part of the modernization of Crown Zellerbach Corp.'s Camas, Wash. mill. By the end of this year, International Paper Co.'s mill in Georgetown, S.C., will be operating the largest displacement bleach plant in the world (Table 3).

The theory behind displacement bleaching is that relative movement between the pulp mass and chemical

TABLE 3: **Displacement bleach plants currently online or scheduled to go online.**

Company	Year of startup	Wood species	Capacity (a.d. tpd)	Designed bleaching sequence[1]
Eastex, Inc., Evadale, Texas	1975, 1978	Softwood	500	C/DEDED
Weyerhaeuser Co., Plymouth, N.C.	1976	Softwood, hardwood	500	C/DEDED
Kymi-Kymmene Oy, Kuusankoski, Finland	1977	Hardwood	170	C/D-E-D-EDED
Oji Paper Co., Ebetsu, Japan	1978	Softwood, hardwood	500	C/DEHED
Tofte Cellulosefabrik A/S Hurum, Norway	1980	Softwood	550	C/DEDE-D
A. Ahlström Oy Varkaus, Finland	1980	Softwood, hardwood	450	C/DEDE-D
Rio Grande Companhia de Celulose do Sul. RIOCEL, Guaiba, Brazil	1981	Hardwood	665	C/DE-DE-D
V/O Prommashimport, Svetogorsk, U.S.S.R.	1982	Hardwood	390	DEDED
Crown Zellerbach Corp. Camas, Wash.	1983	Softwood, hardwood	685	C/DEDE-D
Western Forest Products Squamish, B.C.	1983	Softwood	655	C/DEDE/D
Sappi Ltd., Ngodwana, South Africa	1983	Softwwod	660	D/CED
Pölser Zellulose- und Papierfabrik, Pöls, Austria	1984	Softtwood	640	D/CEDED
Oulu Oy Nouttasaari Mill Oulu, Finland	1983	Softwood, hardwood	850	D/CEDE-D
International Paper Co. Georgetown, S.C.	1984	Softwood	1,100	C/DEDE-D
Mishima, Japan	1985	Softwood	750	CEHED

1. Hyphens represent tower separation.

solutions increases the rate of bleaching. A continuous diffuser provides the movement to do this. The process actually starts outside the tower in a series of dynamic chlorination mixers where chlorine and chlorine dioxide are injected perpendicular to the feedstock. The first mixer "twists" the mixture into the second mixer and then sends it to a thick stock pump. From there the mixture is sent to the first stage of the displacement tower. The unit consists of levels of concentric rings, which govern the capacity of the unit, that have perforated plates on both sides of each ring. The rings are connected by a structure that carries the filtrate out of the tower and into filtrate tanks. In the center of the tower is a vertical rotating shaft that has hollow horizontal arms at each diffuser level with nozzles located between each ring.

Fresh chemical is pumped into packing boxes located on the top of the central shaft, where piping from the boxes delivers it to the hollow arms. The solution flows into the nozzles and is applied to the pulp. Suction between the rings draws chemical through pulp and helps to move pulp up to the next zone. The rings then drop back to their initial position to receive the next load. Pulp delivered by the rings receives the next chemical dose and the process repeats. The last displacement zone, on the top of the tower, is usually a wash stage. Earlier units had five-stages in the tower with a washer on top, but the later models use a conventional second tower, equipped with a diffusion washer, as a final chlorine dioxide stage to achieve a higher final brightness and avoid brightness reversion.

The benefits of displacement bleaching are well known. The most obvious fact is that a single- or two-tower bleachery requires much less space than a conventional design. In addition, displacement bleaching requires less power, less water, less steam and less manpower to operate. Capital investment is also competitive with conventional plants.

Some process design modifications have occurred recently. One is the replacement of the chlorination "twister" mixers with new medium-consistency dynamic mixers. Another modification occurred on the Camas unit recently. Mill engineers noticed that chemicals were not being sufficiently displaced between extraction and the first chlorine dioxide stages, and this was causing unusually high chemical consumption. They decided to switch the wash and the chlorine dioxide stages, which has proven successful.

In the planning stages at Camas and already implemented at two displacement bleacheries is the use of an oxidative extraction stage. Oxygen is injected through the central shaft just before the E_1 zone. Less oxygen is used compared with conventional processes, but the same benefits result. Tower height and proper turbulence in the zone are the chief variables for evaluating application of oxygen in the extraction zone of a displacement tower.

OXYGEN DELIGNIFICATION. Only one of the new greenfield mills starting up this year has employed oxygen delignification with short sequence bleaching. Suppliers believe that corporate mill officials have been a bit too conservative in their design philosophies in rejecting O_2 delignification. Nevertheless, published data on systems running this bleaching technique continue to be favorable.

There are currently five bleaching lines in the U.S. using a first stage to bleach pulp with an oxygen reactor. Worldwide production using this method will reach 16,000 tpd by the end of this year. The first U.S. system was brought online by Chesapeake Corp. at its West Point, Va., mill in 1973. The O_2 reactor is actually after the chlorination stage, a location that is still one of a kind today. The latest system is scheduled to start up later this year at Union Camp Corp.'s new greenfield mill in Eastover, S.C. The unit is the second to be utilized by the company, and is larger than the original 800-tpd process that started up in 1981 at Union Camp's Franklin, Va., mill. Most producers use a short CED bleach line after the O_2 stage to achieve the final brightness targets, but a few use regular five-stage bleaching but with less chemical addition.

Oxygen delignification uses high-consistency (25% to 35%) pulp stock. A fluffer on top of the reaction vessel receives the pulp from a thick stock pump or screw feeder and distributes the stock evenly on a top tray. Gaseous oxygen, typically around 28 to 35 lb/ton, is introduced at the bottom of the reactor and moves through these trays, which provide a large contact area of high-consistency pulp. Stock is normally retained for 25 to 50 min (depending on the particular system and setpoints of that system), and exit kappa number is typically one-half of what it would be following a first chlorination stage. Chemical consumption in the latter stages is therefore much lower, and as a result, bleaching costs are lower. Another major benefit of oxygen delignification is the reduction of effluent from the bleach plant. Mills surveyed that use O_2 delignification report effluent properties such BOD, COD, TOC, toxicity, and color are half of what a conventional five-stage bleach plant would discharge. They maintain that these benefits do offset the relatively high capital investment associated with O_2 delignification.

NEW LINES, SPLITTING OLD ONES. Two of the three new greenfield pulp mills in the U.S. have decided to utilize conventional five-stage bleach plants to achieve fully bleached pulp for market and captive use. Champion International Corp.'s new hardwood market pulp mill at Quinnesec, Mich., will use a C_DE_ODED sequence to bleach pulp to a 90 GE brightness. The new Great Northern Nekoosa Corp., Leaf River, Miss., mill will use a C_DE_ODED sequence to bleach kraft pine to market pulp brightness. As mentioned before, Union Camp's new mill will use oxygen delignification before a conventional C_DE_ODED process for fine paper production, and Crown Zellerbach's Camas modernization project has already started up a four-stage displacement bleach tower followed by a conventional final ClO_2 tower, also for captive use.

The new dynamic medium-consistency mixers have created an opportunity for mills to expand bleaching capacity by splitting the bleaching line. Two mills in the U.S. have already accomplished this, and two more are actively seeking the capital to achieve it.

A published report revealed one example of how a mill added digester capacity and needed cost-effective relief of a bottleneck in the bleaching process.[2] After installing a dynamic medium-consistency mixer and experiencing the promised benefits, the mill decided to convert the existing five-stage bleachery into a parallel sequence with common chlorination. The caustic ex-

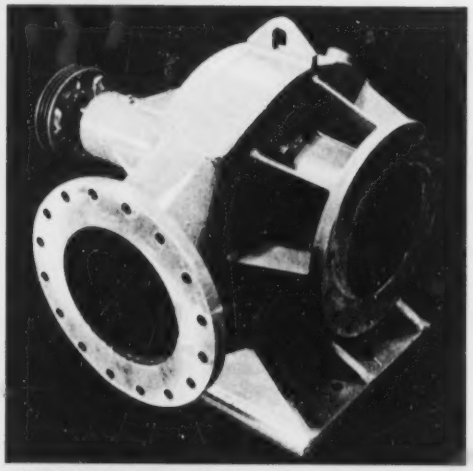
traction stages were converted to oxidative extraction and then fitted with medium-consistency mixers. The stock flow will travel through a conventional chlorination stage, split into the parallel E_OD lines and rejoin at the final chlorine dioxide washer. The new process has achieved brightness specifications for both hardwood and softwood and has maintained pulp quality. It was also found that ClO_2 usage was reduced 4 lb/o.d. ton on hardwood and 7 lb/o.d. ton on softwood.

One mill in Sweden (*P&P*, July 1984, p. 136) split its bleach line after installing an oxygen delignification system and a E_O system with the high-shear mixing

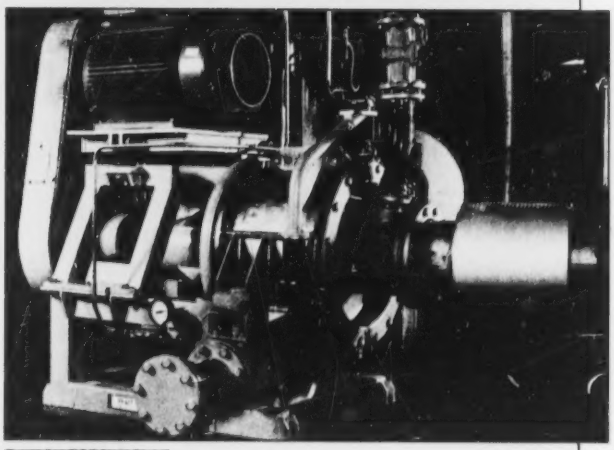
Medium-consistency bleaching is catching on

Medium-consistency (10% to 15%) bleaching is quickly becoming a standard operating process throughout the world (see table below). The new dynamic mixers fluidize stock and chemical inside the mixing zone of the unit, creating a blend that is ideal for reactivity. This technique has helped to lower bleaching production costs by more efficient mixing and has enabled existing sequences to apply cheap chemical additions and substitutions. The new equipment is expensive but the return on investment is quite reasonable (usually less than one year).

Although medium-consistency operations are not new in the pulp mill (continuous digesters run above 10%), the latest successes in bleaching may trigger other process evolutions for medium-consistency applications. Reduced water and energy requirements make medium-consistency processes attractive. Pulp washing and screening are currently being investigated for commercial application. However, until some antiflocculation mechanism is discovered for pulp suspensions, medium-consistency sheet forming will still be an industry fantasy.



IMPCO high-shear mixer.

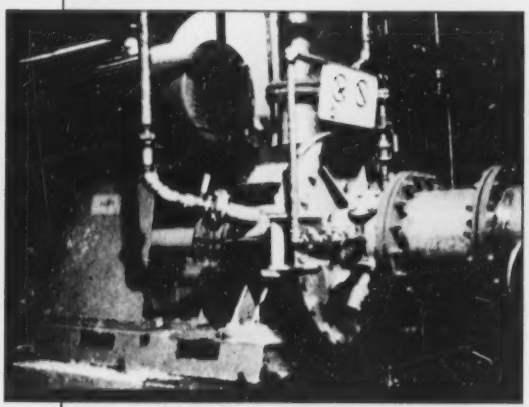


Sunds SMA mixer.

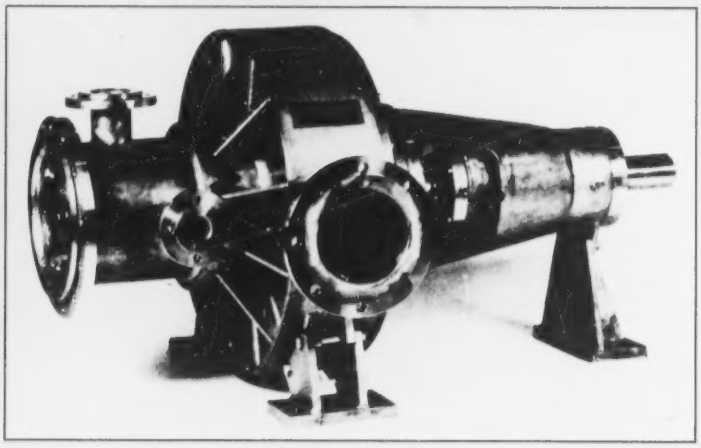
TABLE 4: **Operating specifications for dynamic mixers.**

	Beloit/ Rauma	Kamyr	IMPCO	Sunds Defibrator
Sizes (tpd)	600,800 1,000	600 1,000+	600 1,000+	600 1,100
Dimensions (ft^3)	47 70	45½ 74¼	57 270	50 86⅔
Rpms	530/680	1,000	980/650	735
Motor (hp)	125/200	150/200	125/200	100/270
Consistency range	10–15	8–16	10–15	3–15
Installations*	17	79	33	43
Chlorine	2	10	2	10
Chlorine dioxide	5	44	10	16
Oxidative extraction	10	21	21	13
Others	0	4	0	4

* Sold units worldwide.



Rauma-Repola mixer.



Kamyr MC mixer.

technique and observed similar benefits to the ones mentioned above.

BLEACH PLANT AUTOMATION. The survey revealed continued implementation of process control equipment in bleach plants. Growth of single-stage control seems to be stronger than full control systems in numbers of installations, but many of those installations lead to full bleaching process automation. As with most bleach plant modifications, the existing system and capital available dictate how control is applied and how much. With equipment installations that improve mixing, retention and washing, new instrumentation and control equipment will prove and improve the application of the new process equipment.

The major reason for installing instrumentation and control equipment is reported to be increased accuracy in achieving brightness targets with improved cost efficiency. Flow of stock and chemicals into the towers and the parameters (pH, temperature, retention time, etc.) resulting fron the reaction are monitored for various stages. Control of flows are governed by process variable readings, which can be read foward and/or back. A typical five-stage operation would have between 20 to 50 process measurements and 10 to 15 control outputs.

A single-stage system will use the control variables with the process variables in combination or independently, depending on the manufacturer. Sensor probes mount on a tower and measure variables online using inline or filtrate flow loops. The information is gathered and sent to a microprocessor that uses data in a setpoint controller program, which outputs control modifications. Optical sensors measure brightness, and chemical sensors measure the residual chemical. The sensors and microprocessors work well in the mill environment. A system for control of a single stage will generally cost between $50,000 and $100,000 and pay for itself by optimizing bleaching efficiency (reduced chemical and energy cost) while maintaining a quality product.

Total control systems for the bleaching process (from brownstock washing to high-density storage) are typically ten times larger in capital investment than single-stage control, but offer one-station control over all process variable control and verification. They monitor the bleaching process throughout the plant, controlling flows and reactions as incremental or total production changes occur.

The systems will also retrofit to existing single-stage control and will contribute to millwide control. Original installations of total control systems can be reconfigured for chemical substitution and addition and other sequence modifications. The systems use a series of optical and chemical sensors along the bleaching line that gather data and send it to a centralized operator station with multicolor video displays for each stage. The operator can access setpoints for change and/or watch setpoint controllers act on information from the sensors.

The payback for these systems is also in optimum bleaching efficiency but on a larger scale than a single-stage control system. A major factor in capital investment is the existing instrumentation, which can double the cost of installing a total control system.

WASHING. Following each bleaching stage is a washer, and competition between suppliers of the two types of washing systems has been heated. For existing systems, modifications of washer shower design and preemptive measures for fighting corrosion have been observed. Use of filtrates have also increased in popularity for more efficient washing of pulp.

The Kamyr continuous diffuser has been applied to both conventional and displacement bleacheries for washing and continues to equally share new installations with rotary vacuum drum washers. The diffusion washers are available in single-stage or dual-stage configuration. The units are made of solid titanium and are fully enclosed.

Uniflow washer head installations reportedly were popular again this year. The heads reduce water consumption while improving washing efficiency. Ingersoll-Rand's IMPCO Div. has also entered the washer head market with a new design that retrofits to its drum washers and reduces chemical carryovers with an improved washing shower head. Many mills also reported coating washers with anti-corrosive material (such as Kynar) to lengthen the life of the units.

EFFLUENT CONSIDERATIONS. The bleach plant has always been the major contributor to mill effluent discharges. Many innovative ways of reducing the effluent load in the process are now being investigated commercially. Implementation of many is still not economically feasible, but more stringent environmental laws will help to speed up effluent treatment technology. New lines such as displacement and oxygen delignification have started the trend, but the challenge remains for existing processes.

Color particles (sometimes referred to as "mi-cells") are released into water streams from the bleaching stages. These streams are treated by chemical neutralization, electrochemical processes and filtering before discharge to the environment.

The use of filtrates in bleaching lines for washing has helped to reduce effluent color by reactions that produce oxidizing agents. Elaborate electrochemical oxidation and ultrafiltration systems are currently being studied on commercial sites and have reported successful results.

BLEACH PLANTS OF THE FUTURE. The major suppliers of bleach plant equipment are investigating new ways of bleaching pulp. New technology will improve pulp quality, reduce effluent loads and bleach pulp more economically. The new plants will also be competitive in price compared with conventional plants.

Kamyr has already introduced diffusion bleaching, which allows a plant to bleach and wash pulp in fully enclosed towers. Kamyr is improving on this design by adding pressure to the tower, which will reduce pumping requirements. The design is being evaluated in pilot plant studies, and commercial installation is not far away. IMPCO is currently working on "Low-Level Bleaching," but information on this new concept was not available at press time. ■

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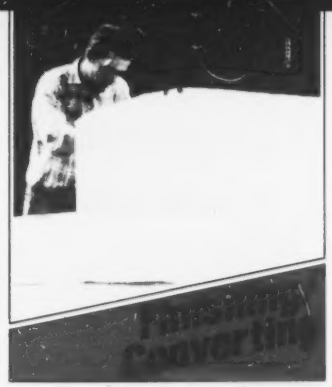


Finishing and converting upgrades

New printing technology and changing paperboard uses have prompted rebuilds and installation of modern finishing and converting equipment

By MATT COLEMAN, Engineering Editor

■ In-house finishing and converting operations, particularly sheeting, have changed significantly in recent years to keep pace with market demands. New cut-size cutter/sheeter lines have been installed in fine paper mills while in many cases older equipment, such as "rough-size" trimmers (guillotines) for coated paper, are being retired as printing technology continues to evolve. Improved printing press designs and lower operating costs, for example, have led many printers to change from sheetfed to webfed presses, reducing the need for large-size sheeting capacity in printing grades. Offsetting this has been an increased use of plain paper copiers, which in turn has increased the need for cut-size sheeters, mostly for free-sheet grades.

CUTTER/SHEETER DISTRIBUTION. Table 1 shows cutter/sheeter and trimmer distribution by region in 1979 vs 1983-84 for mills producing fine-, printing-, and publication-grade paper. All regions except the West increased the total number of cutter/sheeter lines with the Lake States region showing the most dramatic increase in this type of equipment. Modernization of the finishing operation is reflected in the increase in new cutter/sheeter lines and in the decreasing use of trimmers, which produce a rough-size large sheet (folio or equivalent that needs further cutting to reach exact customer specifications).

These trimmers are generally used in coated paper operations, especially heavyweight coated paper, to produce sheets for sheetfed presses. Lightweight coated (LWC) paper use has increased in recent years due primarily to rising postage costs for magazines—the major users of coated stock. LWC is primarily sold in rolls for use in webfed presses. Improved and less expensive webfed presses can now compete for a large portion of the short-run printing that had previously been served by sheetfed presses running the heavier weight paper.

Lightweight coated groundwood, the staple of the U.S. magazine industry, has been in tight supply for the last year—there are indications that actual shortages may soon occur. Imported European coated paper and coated free sheet, both premium priced compared with coated groundwood, have been the only alternatives for small- or medium-size printers left without dealer allocations. Coated paper imports are up 300% over last year. Imported paper runs 10% to 20% higher in price than domestic coated groundwood.

BOXBOARD CONVERTING. Table 2 shows the changes in boxboard and industrial-grade sheeting equipment between 1979 and 1983. As with fine and printing paper grades, all regions except the West showed an increased use of this equipment. This occurred in spite of static production levels (Table 3) and two recessions during that time. Many roofing felt mills (included under industrial-grade equipment) and boxboard mills are now shut down, but the converting equipment is still included in Table 2.

The overall increase shown in Table 2 is somewhat deceptive in that operating rates, specifically for some boxboard grades, have been extremely low. The upturn in the economy that began in the fourth quarter of 1982 has had varying effects on industrial grades with roofing and recycled board benefiting the least. In recycled board, overcapacity in all regions except the West has kept prices low. In the West the market is strong enough to keep prices up but more capacity is due to start up.

Solid bleached sulfate (SBS) board, which once dominated the market, lost share to coated recycled board during the 1970s. The recycled board machines that were added to compete with the SBS machines created some overcapacity. However, a number of these recycled board machines were shut down or ran at reduced rates during the recession. The introduction of solid unbleached sulfate (SUS) board added additional competition to a generally static market. SUS market gains came at the expense of the other two grades. This competition

TABLE 1: **Fine paper and coated paper converting machinery distribution by region, 1979 and 1983.**

	1979		1983	
Region	Cutters/ sheeters	Trimmers	Cutters/ sheeters	Trimmers
Northeast	107	104	111	91
Southeast	70	52	74	35
West	25	15	24	14
Midwest	129	141	161	120

reflect changing market demands

has apparently led to increased sheeter capacity, with each new or converted machine requiring some new sheeter/cutter/trimmer combination. However, recent trends (*P&P*, Aug. 1984, p. 13) show that SBS has recovered sharply in 1984, while continued price weakness in recycled board has led to some mill closures.

Coated boxboard (especially recycled boxboard) has been hard hit by competition and overcapacity. Operating rates were 82% in 1983 and are expected to reach only 88% in 1984. (SBS operating rates were 95.6% in 1983 and could reach 98% in 1984.) The low operating rates have led to weak prices and several mill closures and mill sales. Recently, St. Regis Corp. in Coshocton, Ohio, closed its boxboard mill while Bird & Son Inc. has sold its recycled board mill in East Walpole, Mass.

Chipboard (uncoated recycled boxboard) has been relatively strong because of its use as gypsum board liner. The market is as strong as it was during the 1979 housing boom, according to some market sources.

Recycled boxboard market share is also being eroded by the SUS producers. Greater strength (especially wet strength) make SUS attractive, notably in detergent boxes. Shipments to carton converters were up 13% in 1983 compared with 1982 vs only a 4% increase for clay-coated recycled board during the same period.

Roofing grades are still in a depressed market, with lower housing demand and a general industry transition to fiberglass mat instead of pulp mat pressuring all producers. CertainTeed Corp. recently announced plans to phase out five mills, representing 30% of its capacity. Early this year, GAF Corp. closed three of its 15 roofing mills.

EQUIPMENT CHANGES. Within the boxboard section of the industry, observers look for a gradual shakeout of producers. The weakest mills are expected to go first, which will put some relatively new equipment on the used-equipment market. Most see the converting operations remaining stable, with mills having long-term contracts or specialty contracts continuing to do in-house sheeting. Only the largest carton/box converters will purchase boxboard in rolls.

The converting process in roofing mills will probably not change even with the switch to fiberglass mat. The number of closures and weak prices will make additional improvements in this area unlikely in the near future.

Continued strength in coated paper and uncoated free sheet should lead to more equipment in this area. New cut-size sheeters for copier and writing paper are anticipated. Possible new coated paper mills may include sheeting capacity, and rebuilds of older mills will increase capacity and possibly lead to new equipment purchases (Table 4). ■

TABLE 2: **Boxboard and industrial paper converting machinery distribution by region, 1979 and 1983.**

	1979		1983	
Region	Cutters/ sheeters	Trimmers	Cutters/ sheeters	Trimmers
Northeast	58	71	83	81
Southeast	46	43	51	52
West	17	16	18	16
Midwest	58	82	64	66

TABLE 3: **Paperboard and fine/printing paper-grade production since 1979 (000 short tons).**

	1983	1982	1981	1980	1979
Printing, fine paper	14,403	12,869	12,786	12,541	12,390
Boxboard, industrial	14,944	14,165	14,887	14,710	n.a.

n.a. = Not available.

TABLE 4: **Capacity additions in fine/printing paper, 1979-1984.**

Startup date	Company	Mill site	Capacity (000 tpy)
Uncoated free sheet			
1979	Champion	Courtland, Ala.	150
1979	GNN/Nekoosa	Ashdown, Ark.	130
1980	Boise Cascade	Wallula, Wash.	140
1981	Mead	Chillicothe, Ohio	179
1981	Willamette	Hawesville, Ky.	100
1983	Champion	Courtland, Ala.	140
1984	Crown Zellerbach	Camas, Wash.	160
1984	Union Camp	Eastover, S.C.	210
1983	MB/Island Paper	N. Westminster, B.C.	80 m
1984	Great Lakes Paper	Dryden, Ont.	122 m
Coated free sheet			
1981	Boise Cascade	Rumford, Maine	159
1982	Scott/Warren	Skowhegan, Maine	200
Coated groundwood			
1980	Consol/River	Stevens Pt., Wis.	103
1980	Midtec Paper	Kimberly, Wis.	125
1982	Mead	Escanaba, Mich.	200
1982	St. Regis	Sartell, Minn.	170
1982	Weyerhaeuser	Columbus, Miss.	175

Wastepaper outlook good for '84,

Paper industry speakers discuss the world market and future of industry; steady growth predicted throughout this year to level off in '85

By DEBRA A. ADAMS, Senior News Editor

■ Consumption of paper stock will continue at a steady rate through the rest of this year in the U.S. and many parts of the world, but the long-term outlook is not as optimistic, with some forecasts calling for a worldwide recession within the next two years, according to speakers at the National Assn. of Recycling Industries' (NARI) Paper Roundtable, July 18, in Chicago, Ill.

Rising interest rates and a huge federal deficit in the U.S. are threatening to thwart the economic upturn that began to boost the paper industry during the last half of 1983 and continued through the first half of this year, industry speakers reported. Some fear a recession as early as next year, although most feel 1985 will be relatively flat.

Paper stock buyers representing gypsum, tissue, and newsprint mills all reported at the Roundtable that they expect their businesses to continue at a healthy pace through next year—with only minor cyclical downturns—and they feel their consumption of secondary fiber will continue at its present robust rate during that time.

Robert Hellminski from U.S. Gypsum Co. in Clark, N.J., reported that the paper stock market in the New Jersey area was sloppy early in July, but attributed it to the normal summer slowdown of many industries. The gypsum market, however, continued strong into midsummer, with customers firm on allocation and pricing. These conditions should continue until fall, when demand should level off, he said.

OLD NEWSPRINT GLUTS THE MARKET. Larry Domark from FSC Paper Corp.'s recycled newsprint mill in Alsip, Ill., said the outlook for newsprint for the rest of 1984 is excellent, and he expects "record-breaking demand for paper stock" to continue until year-end, with exports picking up in the fall. Wastepaper supplies, however, should be adequate. In early July, old news supplies were plentiful, he said.

Rick Moore, of Statler Tissue Co., Augusta, Maine, said the tissue industry presently is experiencing one of its cyclical downturns, with an oversupply situation due to capacity increases and intense competition. Statler Tissue uses 100% recycled fiber. Moore expects the tissue market will pick up again later this year, however, and that it will remain strong through most of 1985.

The export market has experienced some changes affecting wastepaper consumption in recent years and this is expected to continue to change buying patterns outside the U.S. for some time to come. European demand has been tapering off since 1980, while consumption in places such as the Far East and Canada is on the rise, the speakers indicated.

Mike Millis of Omega International Corp., Jenkintown, Pa., said European demand for U.S. secondary fiber has dropped 59% since 1980, with only 118,000 metric tons expected to be shipped there in 1984 compared to 288,000 tons in 1980. He attributed the decline to the rise in the U.S. dollar, higher freight rates and customers switching from U.S. suppliers to other sources in Europe and iron curtain countries.

"I've never seen a situation in Europe like there is today," said Millis. He noted that while all other markets—Far East, Canada, Mexico and the U.S.—have broken records in their consumption levels this year, Europe has been declining. "I don't think we can recover from it," he said.

MEXICO A PROMISING MARKET. Mexico is one of the promising future markets for wastepaper exports, according to Richard B. Garrett, of Consolidated Fibres Inc., Dallas, Texas. Mexico will become a more important trading partner with the U.S. once it resolves its financial problems.

Mexico continues to suffer from a weak economy, which has curtailed paper production and capital expenditures, and Mexicans have cut down on luxury items such as disposable diapers and paper napkins. Mills are planning for the future, though. Kraft paper mills are considering switching to linerboard production and fine paper mills are looking at converting to specialty papers, Garrett noted.

The most important sign in Mexico now, though, is the country's aim to increase its exports, which will eventually result in greater consumption of secondary fiber, according to Garrett. During the first six months of this year, Mexico imported more paper stock then in all of 1982, but Garrett said he doesn't expect this rate of demand to continue because inventories are currently high. In good years, Mexico consumes about 1.5 million

NARI Roundtable speakers report

metric tpy of secondary fiber, 900,000 tons of which Mexico generates domestically, he explained.

Canadian consumption of U.S. wastepaper has also been good so far this year, and it is expected to continue through year-end, said Irving Yenoff, of Domtar Packaging, Depew, N.Y. Canada imports approximately one-third of its secondary fiber and virtually all of it comes from the U.S., he said. Yenoff expects that 1984 will be an even better year than 1983, but that 1985 or 1986 will probably see a decline, though not as severe as the one in 1981-82.

In the first quarter of this year, Canada's demand for wastepaper was up 10% from a year earlier, but consumption should drop off for the rest of the year, said Yenoff. The brown grades have been flat for months and pulp substitutes have stopped climbing on the Canadian market. "I think we've gone as far as we're going to go in this business upturn," he said.

Yenoff expects 1985 to be flat and 1986 consumption to decline by 3%. A further devaluation of the Canadian dollar would put even greater downward pressure on imports of paper stock, he noted. The most optimistic forecast for secondary fiber is for the deinking grades, with two new tissue machines recently starting up in Ontario and British Columbia.

KOREA TO EXPAND USAGE. The Far East will also remain a viable market for U.S. wastepaper exports, according to William A. Nielsen of Nielsen & Nielson Inc., Pomona, Calif. The largest consumer of paper stock in the area—South Korea—has increased its usage by 3% to 5% in the past 15 years, he noted. He expects the country to expand the number of grades it currently uses from newsprint, tab cards, and computer printout to less conventional grades such as white and colored ledgers. Consumption of old corrugated containers is also on the rise, he said.

Taiwan will continue to use a wide variety of paper grades, and its consumption is on the rise with an expected 150,000-tpy increase in its paper industry capacity within the next year. Japan, which buys mostly news and OCC, will continue to seek shipments from the U.S., but its buying patterns will remain sporadic, coming in and out of the market at three-month intervals, said Nielson.

In addition to increases in capacity, declining freight rates will also cause a rise in shipments to the Far East. He said the average freight rate between New York and South Korea is $20/ton, and it could drop more this year. Forecasters expect the Pacific Rim countries' economies to grow about 10% annually. The paper industries there should expand 8% to 10% a year, according to Nielson.

The one impediment to a good paper stock market in this area could be the introduction of cheap virgin pulp from Europe, where pulp production has begun to peak, Nielson said. If this happens, the market in the high grades of secondary fiber should start to come down. He expects demand from the Far East in the fourth quarter to remain strong, with South Korea being the strongest market.

R.K. Chopra of Ratna Overseas, New Delhi, India, expects the Indian paper industry to grow by 4% a year—100,000 metric tpy—through 2080. Presently, the 2.06-million-tpy industry is operating 222 mills, with another 24 mills set to come onstream later. The industry has been depressed, however, and operated at just 58% of capacity in 1983, he noted.

"Wastepaper will play an important role in achieving the rate of growth fixed for the industry in the years to come," said Chopra. The biggest obstacle, he said, are freight rates that keep down importation of bulk grades such as mixed and OCC. CPO, however, is selling like "hot cakes." This year India expects to import 150,000 metric tons of wastepaper, with 40,000 to 50,000 tons coming from the U.S. ■

TABLE 1: **Paper stock exports to major consuming countries, January to May, 1980-1984.**

Country	1980	1984	Change (%)
Canada	232,391	138,105	− 40.6
Mexico	261,462	212,486	− 18.7
Venezuela	53,160	46,429	− 12.7
North/South America	561,551	411,099	− 26.8
France	20,836	9,211	− 55.8
Italy	80,425	17,182	− 78.6
Spain	14,326	29,712	+107.4
Europe	126,401	77,786	− 38.5
India	3,200*	11,508	+259.6
Japan	138,426	150,863	+ 9.0
South Korea	220,851	281,455	+ 27.4
Phillipines	19,144	18,865	− 1.5
Taiwan	105,196	312,086	+196.7
Far East/Australia/ Oceania	499,876	812,237	+ 62.5
Total	1,187,828	1,301,122	− 9.5

Source: National Assn. of Recycling Industries from Dept. of Commerce.
*Estimate based on other monthly data 1980 from Dept. of Commerce.

Favorable supply/demand equation adds up to firm U.S. markets ahead

Though the strong dollar may be hurting exports, limited expansions and surging demand brighten the prospects for U.S. producers

By CARL ESPE, News Editor

■ With demand up and only limited capacity additions ahead in the next few years, financial analysts got an upbeat report from industry speakers on the prospects for major grades of pulp, paper and board at the Forest Products Seminar, sponsored by the Financial Analysts Federation in Seattle, Wash., June 18-20.

Although exports to Europe have been hurt by the strong U.S. dollar and a weaker recovery in European economies, demand in Pacific Rim countries continues to grow. And in domestic markets, pulp and paper companies are enjoying the benefits of the booming economy, with U.S. production of paper and paperboard continuing at a record pace.

FIRM PULP MARKETS. Continued growth in market pulp demand and limited capacity expansion indicate a relatively firm market for pulp over the next two years, Fred Robertson, president of Mead Pulp Sales Inc., told analysts. He said the market is currently faced with more than the usual amount of uncertainties, partly due to the impact of the British Columbia strike that resulted in the loss of 700,000 tons of production earlier this year. "Nevertheless," he said, "prices have firmed, discounting has virtually disappeared, and orders are flowing at normal rates."

Market pulp shipments from Norscan and other countries jumped an unprecedented 19% last year to a new record of 22.3 million tons, up from 18.9 million tons in 1982. About 15% to 20% of this 3.356-million-ton jump probably went into buyer and broker inventories, while the rest was consumed, Robertson estimated. Most of the inventory building probably took place in western Europe, People's Rep. China, Asia (excluding Japan) and Africa.

The International Statistical Committee of the North American & Nordic Producers Assn. has estimated that world chemical paper-grade market pulp demand will grow 5.0% from the record 22.3 million tons shipped in 1983 to 23.5 million tons in 1985.

Western Europe, which consumes about 40% of world pulp shipments, should show relatively slow demand growth. This reflects slowing economic growth (1.2%/year between 1982 and 1987) and further market inroads by integrated Scandinavian producers. Demand in Pacific Rim markets, however, should continue to rise at a rapid pace. And the fluff pulp market, which is now around 1 million tons, will continue to grow at several times the rate of paper end uses, Robertson said.

SLOW CAPACITY GROWTH. North American and Scandinavian capacity for chemical paper-grade market pulp will increase by only 4%, or 780,000 metric tons, over the next two years to 18.55 million metric tons in 1986. The three Nordic countries will show a small decline over this period, while Canadian capacity will rise

TABLE 1: **World chemical paper-grade market pulp capacity, potential production, demand (000 metric tons).**

	1982	1983e	1984e	1985e
Capacity				
Total world[1]	24,510	24,880	25,280	25,875
Potential production[2]				
Total	22,790	23,230	23,000[3]	24,135
Demand				
Canada	610	735	790	800
U.S.	3,940	4,725	4,950	4,900
Nordic	820	980	990	945
Western Europe	8,120	9,145	9,500	9,450
Eastern Europe	260	255	240	240
Latin America	935	1,015	1,050	1,100
Japan	1,950	2,265	2,550	2,700
Oceania	275	255	240	240
Asia/Africa[4]	2,075	2,960	2,925	3,075
Total	18,985	22,335	23,235	23,450
Ratio				
Demand/potential production	83%	96%	101%	97%

e = Estimate.
1. Excluding eastern Europe and People's Rep. China.
2. Potential production: 95% of capacity for North America and the Nordic countries, 90% of capacity for western Europe, Japan (and Latin America 1983-85), 85% of capacity for others (and Latin America 1982).
3. Partially adjusted to include tonnage lost in British Columbia strike.
4. Including People's Rep. China.
Source: American Paper Institute.

by only 2%, or 150,000 tons. The biggest increase, 670,000 tons, will occur in the U.S., where two large projects will start up this year.

Additional pulp capacity from non-Norscan sources is expected to rise by 7%, or 510,000 tons, between 1983 and 1985. This does not include the U.S.S.R. and eastern Europe, which are not expected to expand production significantly for several years. (The U.S.S.R.'s exports to western Europe in 1983 amounted to about 250,000 tons, up from 205,000 tons in 1983. Czechoslovakia added about 50,000 tons to its exports in 1983.)

Brazil continues to make good progress in developing exports of its eucalyptus hardwood pulp. Exports have grown from 273,000 tons in 1978 to an estimated 930,000 tons in 1983. Over the same period, eucalyptus has grown from 24.7% of total world bleached hardwood production to an estimated 33.6% in 1983. Brazil in 1983 was the largest bleached hardwood pulp exporter, followed by the U.S. (837,000 tons), Finland (596,000 tons), and Portugal (479,000 tons).

The International Statistical Committee projects that demand to potential production ratios for Norscan producers will rise from 94% in 1983 to 102% in 1984 after adjustment for the British Columbia strike and 96% in 1985. (Potential production is based on 95% of capacity.) Operating rates worldwide, including both Norscan and nontraditional producers, would be slightly lower over the same period (Table 1).

Robertson said that the ratio of demand to potential production over the 1978-80 period was similarly strong, ranging from 92% to 100%, and during this period the industry achieved seven consecutive quarterly price increases. The economic forecasting firm, Data Resources Inc., is projecting an average price for northern bleached softwood kraft in 1986 of $700/metric ton, up from the present price of $540/metric ton, he noted.

The strength of the dollar has dramatically altered the comparative cost relationships among major world pulp producers in recent years, Robertson said (Table 2). His latest estimates of average manufacturing costs (excluding interest, depreciation and delivery costs) show that western Canada is the lowest cost producer in softwood ($277/metric ton), followed by Sweden ($289). The U.S. South is high ($335). Scandinavian, however, have the lowest delivered cost to western Europe.

FAVORABLE LINER MARKETS. U.S. kraft linerboard supply and demand should remain in favorable balance over the next couple years, two paper industry executives told security analysts attending the meeting.

Carl W. Geist Jr., vice president of containerboard for Weyerhaeuser Co., projected total U.S. linerboard demand would rise 6.7% in 1984 to 17.1 million short tons and 3.7% in 1985 to 17.8 million tons. With capacity only expected to show limited growth, this would result in operating rates of 96% this year and 98% in 1985.

Domestic kraft linerboard demand will be helped by a projected 7.0% rise in U.S. corrugated box shipments in 1984 followed by a 4.0% rise in 1985. Box shipments closely track industrial production, which is expected to rise 12.4% this year and 6.0% in 1985, he noted.

The strong U.S. dollar may contribute to a slight decline in U.S. liner exports from 2.1 million short tons in 1983 to 2.07 million tons this year, but shipments should rebound to nearly 2.3 million tons in 1985.

PACIFIC RIM GROWTH. Export demand from the Pacific Rim countries will continue to show the strongest growth, he said. Since 1979, the Pacific Rim's share of U.S. kraft linerboard exports have nearly doubled, from 15.6% to 30.2% in 1983, while Europe's share has declined from 39.5% to 33.6%.

A strong economic recovery will continue in Japan through 1985, lifting demand for boxes and linerboard. Domestic Japanese linerboard consumption should rise about 10% to 3.96 million metric tons in 1984 and 8% to

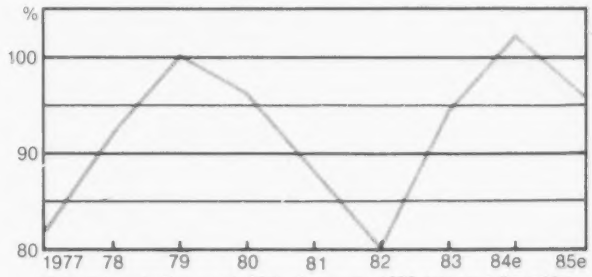
TABLE 2: **Estimated 1984 average costs of producing bleached kraft paper-grade market pulp at existing mills (US$/a.d. metric ton).**

	Softwood			
	Western Canada	Sweden	Finland	U.S. South
Fiber	109	184	227	120
Chemicals	41	31	26	50
Energy	36	12	8	45
Wages/salaries	49	35	31	60
Other	42	27	27	60
Total[1]	**277**	**289**	**319**	**335**

	Hardwood				
	Brazil	Portugal	Sweden	Finland	U.S. South
Fiber	55	55	146	155	103
Chemicals	20	31	22	27	41
Energy	15	26	15	10	53
Wages/ salaries	27	33	33	31	60
Other	40	55	25	27	67
Total[1]	**157**	**200**	**241**	**250**	**324**

1. Excluding interest and depreciation. Source: Mead Pulp Sales Inc.

FIGURE 1: **Ratio of Norscan shipments to potential production through past two business cycles, 1977-85.**



Potential production equals 95% of capacity. 1979 data are adjusted for capacity overstatement. Source: Mead Pulp Sales Inc.

Nevertheless, imports of kraft liner into Japan will probably not surge due to strong demand and attractive prices in the U.S. and other world markets, Geist said. He projected that total Japanese liner imports would rise from 240,000 metric tons in 1983 to 297,000 tons in 1985.

Over the longer term, the Japanese market outlook is highly positive, with corrugated box shipments forecast to rise at a 4% to 5% annual rate. "Supply to meet this market growth will come more from kraft linerboard imports rather than from Japanese capacity increases," Geist said. "Stronger yen and higher imported fiber and energy costs will lessen competitiveness of the Japanese containerboard industry relative to U.S. West Coast mills." One of the challenges for the U.S. industry, however, will be to meet Japanese linerboard quality requirements in regard to compression strength, printing surface and other factors.

WESTERN EUROPE. Geist projected western European kraft linerboard demand would rise 2.2% to 2.55 million metric tons in 1984 and 2.3% to 2.6 million tons in 1985. U.S. exports to western Europe, however, are expected to decline from 660,000 metric tons in 1983 to 605,000 tons in 1984 and then rebound to about 660,000 tons in 1985. U.S. exports are being hurt by the slower economic recovery in most European countries and the competitive advantage of Scandinavian kraft liner and Continental test liner suppliers due to the strong U.S. dollar.

Frederick V. Ernst, group vice president for pulp and paper of Chesapeake Corp., noted that one of the factors contributing to the favorable domestic supply/demand balance for kraft linerboard is limited capacity expansion. According to revised American Paper Institute data, U.S. capacity is expected to rise only 1.8%/year over the 1984-86 period.

LIMITED CAPACITY GROWTH. Chesapeake is the only company to announce plans to install a new kraft linerboard machine over this period, although Inland Container Corp. is building a new recycled linerboard mill in the Los Angeles, Calif., area.

Part of the reason that companies have not jumped to add new capacity is that "there has been a major effort in the last several years to eliminate bottlenecks and gain incremental capacity on existing machines," Ernst said. High-loaded presses such as the Extended Nip press on wet ends of paper machines are an example.

He noted that API recently revised its 1984 capacity figures by some 455,000 short tons, or 2.5% above the figures reported in early 1983. "More than half of this additional capacity appears to be related to previously unannounced increases in mill productivity."

SWING CAPACITY. A considerable amount of swing linerboard capacity is available that had previously been used to make kraft paper grades. Of the 455,000-ton increase announced by API, an estimated 210,000 tons have come from kraft paper capacity being shifted to linerboard, Ernst noted.

Multiwall sack kraft paper demand has been depressed by the recession and the federal government's Payment-In-Kind program, but demand may bounce back to its previous level of around 1.0 million tons. But the 2.2-million-ton grocery bag and sack market faces serious competition from plastic film, and some predict that plastic bags will capture 25% or more of the grocery sack market in the next few years, Ernst said.

"While there is a great deal of controversy as to the degree to which plastics will penetrate this market, we have no doubt that plastics will turn grocery bag and sack usage into a declining market." However, a recent study by API indicates that plastic inroads into this market may be increasing at a slower rate after reaching about 5% in 1983, he said.

Kraft paper capacity has been declining for a number of years, dropping from 4.3 million tons in 1977 to an estimated 3.7 million tons in 1984 (excluding another 150,000 tons that will be swung to linerboard and 290,000 tons that will be converted to bleached paper grades over the next two years).

"So while future linerboard capacity will certainly be affected by incremental expansions and by a gradual shift of capacity from kraft paper to linerboard, this is essentially being accounted for by the negative growth in kraft paper capacity and the very minimal growth of linerboard capacity," Ernst said.

UPBEAT FREE-SHEET OUTLOOK. Heavily driven by the forms and business papers segments, demand for uncoated free-sheet papers will grow at an average annual rate of 3.5% between 1983 and 1993, according to Boise Cascade Corp. vice president and White Paper Div. general manager, Terry Lock.

Society is shifting toward an information culture where data is cheap, readily accessible and voluminous, Lock told analysts. As such information-age tools as computers, copiers and word processors spread, so too will demand for uncoated free sheet—particularly forms and business papers. Boise Cascade forecasts that uncoated free-sheet shipments will grow from a base of 8.7 million tons in 1983 to 12.2 million tons in 1993, an overall increase of 3.5 million tons, or 40%, over the ten-year period. Over the same period, gross national prod-

Chesapeake Corp. will present a paper on its innovative new linerboard machine and Carl Geist will describe the outlook for U.S. liner exports at *Pulp & Paper*'s First International Unbleached Kraft Conference, Nov. 12-13, 1984, at the Vista International Hotel, New York, N.Y. For information contact:

Pulp & Paper Seminar Dept.,
370 Lexington Ave.,
New York, N.Y. 10017
Telephone: (212) 683-9294.

TABLE 3: **Projected U.S. kraft linerboard supply and demand (000 short tons).**

	1982	1983	1984e	1985e
Demand				
Domestic	12,715	13,968	15,069	15,482
Export	1,820	2,100	2,070	2,295
Total	14,535	16,068	17,139	17,777
Supply	16,588	17,014	17,800	18,043
Operating rate	88%	94%	96%	98%

e=Estimate.

8.7 million tons in 1983 to 12.2 million tons in 1993, an overall increase of 3.5 million tons, or 40%, over the ten-year period. Over the same period, gross national product is expected to grow at an average annual rate of 2.9%, while the industrial production index will climb 3.7% a year. In the shorter term, Boise Cascade expects demand to grow 4.5% this year and 5.0% in 1985.

Uncoated free-sheet production in the U.S. totaled 8.7 million short tons in 1983, about 13% of total U.S. paper and paperboard output. Although free-sheet products are essentially interchangeable, different distribution channels allow the grade to be broken up into market segments. At 25% apiece, offset and business papers are the largest two segments, followed by form bond at 20%, envelope at 8%, tablet at 5%, and cover and text at 3%, with other products accounting for the remaining 14%.

Over the past ten years, uncoated free-sheet shipments have grown at an average annual rate of 2.7%, Lock said, increasing the size of the market by 30%, or 2 million tons. This compares favorably with other paper and board grades, where growth ranged over the same period from a 4.8%/year rate for coated free-sheet papers to a 0.6% annual decline for kraft papers.

The bulk of uncoated free-sheet demand since 1973 has occurred in the forms bond and business papers segments, fueled by the growth of such end-uses as copiers, up 20% a year, and computers, up 15% a year. Over the past ten years, shipments of business papers grew 56%, from 1.4 million tpy in 1973 to 2.2 million tpy in 1983. Forms bond shipments almost matched that pace, rising 53% over the same period, from 1.1 million tpy in 1973 to 1.7 million tpy last year, the Boise Cascade executive said. In contrast, tablet shipments rose 31% between 1973 and 1983; offset, 20%; and envelope, 23%.

CAPACITY ADDITIONS. Uncoated free-sheet's supply/demand relationship has been reasonably good over the past decade, Lock pointed out. Capacity was added at the rate of 3.0% per year from 1973 to 1983, compared to demand growth of 2.7% a year, and operating rates averaged 91.4%. Based on historical operating rates, uncoated free-sheet capacity will need to increase by 3.6 million tons over the next ten years to meet forecast dend, Lock said. Working out to 3.9%/year, such an increase would boost capacity from 9.2 million tons in 1983 to 12.8 million in 1993, enough to meet projected demand of 12.2 million tons at 95% operating rates.

Boise Cascade expects U.S. producers to go ahead with the required expansion—equivalent to 1.7 new paper machines a year—although at least half of the capacity expansions will be accomplished through rebuilds of existing machines, he added. The company expects capacity to grow 4.7% this year and 6.0% in 1985 as new and converted machines come online.

Tight markets rather than competitive disadvantage govern uncoated free-sheet imports into the U.S., according to the Boise Cascade executive. Imports have grown dramatically this year, rising from 221,000 tons in 1983 to an annualized rate of 500,000 tpy in mid-1984. Imports are expected to diminish, however, due to such problems as longer lead times and less service offshore. The new domestic capacity coming online this year should also ease tight markets. Imports have been concentrated in tablet, stock tab and offset, Lock said, tending toward heavier-weight, commodity-type products.

LWC FORECAST. Demand for lightweight coated paper will grow an average of 4.1%/year over the next ten years, Boise Cascade forecast, compared to a growth rate of 4.5% over the past ten years. Growth will be fueled by the same macroeconomic factors affecting uncoated free sheet but with different end-use factors, including growth in advertising, magazines, commercial printing, direct mail and catalog. U.S. producers shipped 3.0 million tons in 1983, and a 4.1%/year growth rate would translate into an additional 1.5 million tons by 1993, a 49% increase over current levels. ■

TABLE 4: **Projected western European kraft liner supply and demand (000 metric tons).**

	1983	1984e	1985e
Total kraft liner demand	2,495	2,551	2,611
Western European capacity			
Scandinavia	1,260	1,270	1,307
Other western Europe	663	690	715
Total capacity	1,923	1,960	2,022
Minimum required imports	572	591	589
Estimated imports	895	870	940

Source: Weyerhaeuser Co.

FIGURE 2: **Uncoated free-sheet shipments, historical growth by grade segment.**

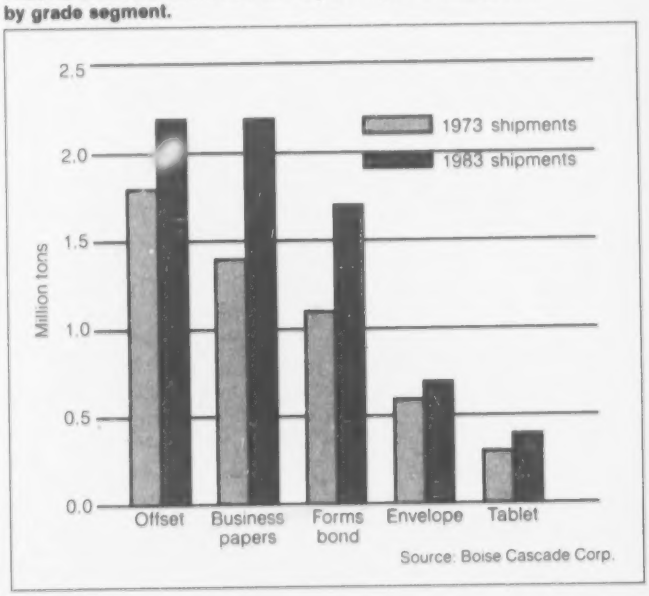
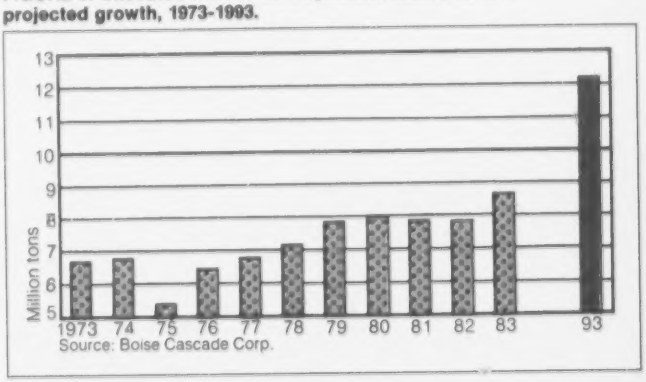


FIGURE 3: **Uncoated free-sheet shipments, historical and projected growth, 1973-1993.**



Peroxide demand by mills continues to rise in 1984

By BARRY SHOCKETT

The surge in domestic consumption of hydrogen peroxide, which began in the second half of 1983, has continued into 1984, albeit at a lower rate since the summer. The sharp boost in peroxide demand resulted in an unusually high level of imports—by the end of May, more than 8,000 tons (as-is basis) had been imported. However, as production picked up this year, imports dropped substantially—the total for 1984 being estimated at 10,000 tons.

By 1986, Canada should be a net exporter of hydrogen peroxide as DuPont Canada (40,000 tons) and FMC (11,000 tons) begin domestic production in Maitland, Ont., and Squamish, B.C., respectively.

U.S. statistics, hydrogen peroxide (000 short tons[1])

	1981	1982	1983	1984e
Nameplate capacity	193	193	179	179
Production	112	110	123	137
Apparent consumption	107.5	105	115	129
Pulp bleaching	13	13.5	15.5	17
Exports	8	8.2	11.2	14
Imports	3.5	3.2	3.1	6

1. On 100% basis. e = Estimated.
Sources: Bureau of Census, U.S. Dept. of Commerce; *Pulp & Paper* estimates.

Canadian statistics, hydrogen peroxide (000 short tons[1])

	1981	1982	1983	1984e
Total demand	7.2	7.5	8.9	11.0
Pulp bleaching	4.9	5.1	6.4	7.1
Miscellaneous[2]	2.5	2.4	2.5	3.3
Imports	7.2	9.6	11.3	12.0

1. On 100% basis. e = Estimated.
2. Including textile bleaching and water treatment.

HYDROGEN PEROXIDE

UNITED STATES

Uses: Hydrogen peroxide is used by the pulp and paper industry to bleach chemical and mechanical pulps as well as to deink recycled newspaper stock. The major use of H_2O_2 is as a chemical intermediate.

Demand: An estimated 17,000 tons of H_2O_2 will be used by pulp mills in 1984 compared with the 15,500 tons used in 1983. Total consumption is expected to increase to 129,000 tons from the 115,000 tons estimated for last year. Chemicals, textiles, and municipal water treatment together account for 52% of peroxide demand compared with the 13% to 14% held by pulp mills. Industrial effluent treatment (9%) is continuing strong growth.

Sources: The three U.S. producers (in descending order of capacity) are: FMC, E.I. DuPont, and Interox America. FMC's 10,000-tpy expansion at its Bayport facility, due onstream by year-end, will bring domestic capacity to the 189,000-ton level for 1985. By the end of 1986, North American capacity should reach the 240,000-ton mark.

Availability: The increase in North American capacity over the next two years will ensure an adequate supply for the foreseeable future. 1984, market; 1983, market; 1982, market; 1981, market; 1980, market; 1979, market; 1978, market.

Pricing: Peroxide prices rose 2¢/lb on July 1, about 18 months after the previous boost. Until Jan. 1, 1983, prices had been steady for two years. The bulk 70% solution tag is now 45¢/lb, f.o.b. works, freight equalized. Pricing history: 1983, 43¢/lb; 1982, 39.5¢/lb; 1981, 39.5¢/lb; 1980, 35.5¢-36.5¢/lb; 1979, 32.5¢/lb.

Forecast: Continued growth in mechanical pulping and greater H_2O_2 usage by kraft mills could easily result in a 9% to 10% increase in pulp mill demand in 1985. However, a more conservative figure for next year is 18,000 tons. The next price boost should occur in mid-1985.

CANADA

Uses: Mechanical pulp bleaching and chemical pulp bleaching account for most of the H_2O_2 consumed in Canada. Other end uses include textile bleaching and water treatment.

Demand: Hydrogen peroxide usage in the pulp and paper industry was up about 25% last year to an estimated 6,400 tons compared with the 5,100 tons used in 1982. Consumption in 1984 is expected to reach 7,700 tons with total demand rising to 11,000 tons compared with almost 9,000 tons in 1983.

Sources: Peroxide imports continue to supply the total Canadian market, but the share of U.S. shipments in 1983 dropped to about 76% of the total (from 90%). Major importers are still C-I-L (from FMC), DuPont Canada (from its U.S. parent), and Interox America (via its new Toronto terminal).

Availability: There is enough U.S. capacity to handle Canadian needs for at least the next two years. 1984, market; 1983, market; 1982, market; 1981, tight to market; 1980, market to tight.

Pricing: Prices went unchanged for 18 months and then rose about 10.5% on July 1, reflecting the price boost in the U.S. Bulk, 70% solution, tank trucks, f.o.b. Toronto, Ont./Montreal, Que., is now $1.43/kg (65¢/lb). Pricing history is as follows: 1983, $1.295/kg (58.7¢/lb); 1982, $1.157/kg (52.5¢/lb); 1981, $1.157/kg (52.5¢/lb); 1980, 95.8¢ to $1.05/kg (43.5¢ to 47.6¢/lb); 1979, 90.6¢ to 95.8¢/kg, (43.1¢ to 43.5¢/lb).

Forecast: The continued growth in thermomechanical pulping combined with the switch of some newsprint mills to higher-brightness groundwood specialties could boost H_2O_2 demand to almost 9,500 tons in 1985 and to 17,000 tons in 1988. No further price hikes are anticipated before the middle of next year.

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